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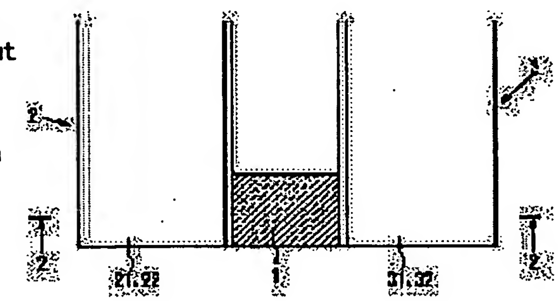
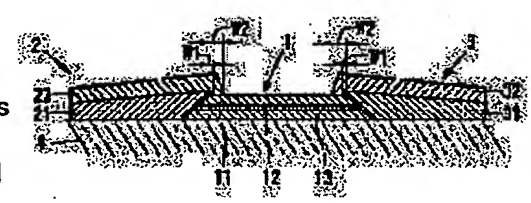
(54) MAGNETO-RESISTIVE EFFECT ELEMENT AND ITS MANUFACTURE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an MR element, a thin film magnetic head and these manufacture without increasing an electric resistance value due to an insensitive band.
SOLUTION: End part passive areas 2, 3 are provided on both side ends of a central active area, and respective areas contain magnetic domain control films 21, 31 and conductive films 22, 32. The magnetic domain control films 21, 31 are overlapped partially on the surface of the central active area 1. The conductive films 22, 32 are stuck to the surface of the magnetic domain control films 21, 31, and are overlapped on the surfaces of the magnetic domain control films 21, 31 and the central active area 1. The overlapped size W2 of the conductive films 22, 32 on the surface of the central active area 1 is larger than the overlapped size W1 of the magnetic domain control films 21, 31 on the surface of the central active area 1.





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CLAIMS

[Claim(s)]
[Claim 1] It is a magneto-resistive effect component including a central active region and an edge passivity field. Said edge passivity field It prepares for the both-sides edge of said central active region. Each of said edge passivity field The magnetic-domain control film and the electric conduction film are included. Said magnetic-domain control film It has lapped with the front face of said central active region partially. Said electric conduction film The front face of said magnetic-domain control film adhered, it has lapped with the front face of said magnetic-domain control film and said central active region, and the lap dimension of said electric conduction film to the front face of said central active region is larger than the lap dimension of said magnetic-domain control film to the front face of said central active region.
[Claim 2] It is the magneto-resistive effect component indicated by claim 1, and the lap dimension of said electric conduction film to the front face of said central active region is equal in the both-sides edge of said central active region.
[Claim 3] It is the magneto-resistive effect component indicated by any of claims 1 or 2 they are, and the lap of said electric conduction film to the front face of said central active region exceeds the deadband produced in said central active region.
[Claim 4] It is the magneto-resistive effect component indicated by claim 3, and said deadband is 0.15-0.5 micrometers of abbreviation at one side.
[Claim 5] It is the magneto-resistive effect component indicated by any [claim 1 thru/or] of 4 they are, and said central active region contains the magnetic-anisotropy magneto-resistive effect film.
[Claim 6] It is the magneto-resistive effect component indicated by any [claim 1 thru/or] of 4 they are, and said central active region is the giant magneto-resistance film.
[Claim 7] It is the magneto-resistive effect component indicated by claim 6, and said giant magneto-resistance film contains the spin bulb film.
[Claim 8] It is the magneto-resistive effect component indicated by claim 6, and said giant magneto-resistance film contains the ferromagnetic tunnel junction film.
[Claim 9] It is the magneto-resistive effect component indicated by any [claim 1 thru/or] of 8 they are, and said magnetic-domain control film contains the hard magnetism film.
[Claim 10] It is the magneto-resistive effect component indicated by claim 5, and said magnetic-domain control film contains the antiferromagnetism film, and adds vertical bias to said magnetic-anisotropy magneto-resistive effect film using the antiferromagnetism-ferromagnetism switched connection produced between said antiferromagnetism film and said magnetic-anisotropy magneto-resistive effect film.
[Claim 11] It is the thin film magnetic head containing a magneto-resistive effect component, and it came to indicate said magneto-resistive effect component any [claim 1 thru/or] of 10 they are.
[Claim 12] It is the thin film magnetic head indicated by claim 11, and said magneto-resistive effect component is used as a reading component.
[Claim 13] It is the thin film magnetic head indicated by claim 12, and a write-in component is included further.
[Claim 14] It is the manufacture approach of the magneto-resistive effect component indicated by any [claim 1 thru/or] of 10 they are. Said magneto-resistive effect component It has the

central active region and the edge passivity field. Said edge passivity field It prepares for the both-sides edge of said central active region. Each of said edge passivity field The magnetic-domain control film and the electric conduction film are included. Said magnetic-domain control film It has lapped with the front face of said central active region partially. Said electric conduction film The front face of said magnetic-domain control film adhered, have lapped with the front face of said magnetic-domain control film and said central active region, and the lap dimension of said electric conduction film to the front face of said central active region It is larger than the lap dimension of said magnetic-domain control film to the front face of said central active region. Said magnetic-domain control film and said electric conduction film By the vacuum forming-membranes method, membranes are formed on mutually different membrane formation conditions, and the lap dimension to said central active region of said electric conduction film is made larger than that of said magnetic-domain control film by it.

[Claim 15] It is the manufacture approach indicated by claim 14, and said vacuum forming-membranes method is performed with the combination of vacuum evaporationo, sputtering, or both.

[Claim 16] It is the manufacture approach indicated by claim 14. Said vacuum forming-membranes method It is sputtering. Said central active region Membranes are formed on the whole surface of a substrate and a mask is arranged above said central active region. After forming said magnetic-domain control film on the membrane formation conditions which are mainly concerned with the atom which carries out incidence perpendicularly to said whole surface of said substrate, said electric conduction film is formed on the membrane formation conditions which are mainly concerned with the atom which carries out incidence in the direction of slant to said whole surface of said substrate.

[Claim 17] Said vacuum forming-membranes method is sputtering, said substrate is carried on a rotor plate, it is the manufacture approach indicated by claim 14, and said magnetic-domain control film forms [it quiescence-forming / membranes /-method-****** and] said electric conduction film by the rotation forming-membranes method make said rotor plate stand it still and make said rotor plate revolve around the sun.

[Claim 18] It is the manufacture approach indicated by claim 14, and said vacuum forming-membranes method is sputtering, said substrate is carried on a rotor plate, said magnetic-domain control film forms membranes with the combination of the diaphragm with a mask, and the rotation forming-membranes method make said rotor plate revolve around the sun, and said electric conduction film forms membranes by the rotation forming-membranes method make said rotor plate revolve around the sun.

[Claim 19] It is the manufacture approach indicated by claim 14. Said vacuum forming-membranes method It is sputtering and the 1st rotor plate and 2nd rotor plate are included. Said 2nd rotor plate It is prepared on the 1st rotor plate, and said substrate attaches offset from the rotation core of said 2nd rotor plate, and is formed on the whole surface of said 2nd rotor plate. Said magnetic-domain control film Membranes are formed with the combination of the diaphragm with a mask, and the rotation forming-membranes method make said 1st rotor plate revolve around the sun, and said electric conduction film stops revolution of said 1st rotor plate, and forms membranes by the rotation forming-membranes method make said 2nd rotor plate rotate.

[Claim 20] It is the manufacture approach indicated by claim 14, and said magnetic-domain control film is formed by vacuum evaporationo, and said electric conduction film is formed by sputtering.

[Claim 21] It is the manufacture approach indicated by claim 14, and said magnetic-domain control film and said electric conduction film are formed in the different vacuum membrane formation interior of a room.

[Claim 22] It is the manufacture approach of the thin film magnetic head containing a magneto-resistive effect component, and said magneto-resistive effect component is manufactured by the approach indicated by any [claim 14 thru/or] of 21 they are.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a magneto-resistive effect component (MR component is called below), the thin film magnetic heads, and those manufacture approaches.
[0002]
[Description of the Prior Art] Since an output is not related to the relative velocity between magnetic disks, the thin film magnetic head which read MR component and was used as a component in the inclination for magnetic disk drive equipment to be miniaturized is conventionally known as transductor suitable for reading the information memorized by the magnetic-recording medium with high recording density.
[0003] The magnetic sensing element used for the thin film magnetic head is known for JP,3-125311,A etc. The magnetic-reluctance reading machine indicated by this reference has a central active region and the edge passivity field of a pair. As for a central active region, the soft magnetism film adds horizontal bias to MR film including the magneto-resistive effect film (MR film is called below), a nonmagnetic membrane, and the soft magnetism film. The edge passivity field of a pair contains the magnetic-domain control film and the electric conduction film. Each of the magnetic-domain control film separates spacing on both sides which a central active region faces mutually, a laminating is carried out to them, and it adheres to the electric conduction film on the magnetic-domain control film.
[0004] The soft magnetism film contained in a central active region adds horizontal bias to MR film, and secures the linearity actuation at the time of reading the data magnetically recorded by it. If the field produced from the magnetic-recording data on a magnetic-recording medium is added in the direction which intersects the direction of magnetization of MR film to MR film, the direction of magnetization of MR film will change. And the resistance of MR film changes according to the direction of magnetization, and the sense current corresponding to it flows. Since the direction of magnetization does not change when the field produced from the magnetic-recording data on a magnetic-recording medium is in agreement with the direction of magnetization of MR film, the resistance of MR film hardly changes.
[0005] The magnetic-domain control film adds vertical bias to MR film, and it has it in order to prevent a Barkhausen noise. The U.S. Pat. No. 4,024,489 number specification is indicating MR sensor which used the hard magnetism bias film as magnetic-domain control film.
[0006] In MR component mentioned above, since the vertical bias by the magnetic-domain control film is strong and horizontal bias does not start near the adhesion field of the magnetic-domain control film to MR film, the deadband which does not operate as a sensor is produced. A deadband does not function as a sensor but makes the electric resistance value of a magnetic-reluctance sensor circuit increase. When the electric resistance value of a magnetic-reluctance sensor circuit increases, the danger of electromigration generating resulting from a high density current is made a limit not only to join the engine performance as a magnetic-reluctance sensor circuit, but to amplify.
[0007] As a means to reduce the electric resistance value by the deadband, the electric conduction film is given to the both-sides edge of a central active region exceeding a deadband. In that case, since a deadband is equally produced at the both-sides edge of MR film, the electric conduction film needs to form membranes equally in the both-sides edge of MR film.

When it becomes unequal, the fall of the magnetic dependability by MR film in which increase of the electric resistance value by the non-actuation field or lower layer actuation of the electric conduction film is possible will still be caused.
[0008] For example, U.S.Pat.No.5,438,470 No. is indicating the structure of being the same dimension and putting the structure of putting only the electric conduction film on a central active region, and the magnetic-domain control film and the electric conduction film on a central active region. However, in the case of the structure of putting only the electric conduction film on a central active region, the difficulty on manufacture that alignment of the side edge side of the magnetic-domain control film must be correctly carried out so that it may be in agreement with the side edge side of a central active region is produced. Moreover, the structure of putting the magnetic-domain control film and the electric conduction film on a central active region with the same dimension produces a trouble which has been stated with the above-mentioned patent specification.
[0009] Furthermore, U.S.Pat.No.5,438,470 No. is indicating the structure which equated the lap dimension of the electric conduction film to a central active region in the both-sides edge of MR film. However, about the means for equating the lap dimension of the electric conduction film, nothing has made reference.
[0010]
[Problem(s) to be Solved by the Invention] The technical problem of this invention is offering MR component which does not cause the electric resistance value increase by the deadband, the thin film magnetic heads, and those manufacture approaches.
[0011]
[Means for Solving the Problem] MR component concerning this invention includes a central active region and an edge passivity field for the technical-problem solution mentioned above. The both-sides edge of said central active region is equipped with said edge passivity field, and each of said edge passivity field contains the magnetic-domain control film and the electric conduction film.
[0012] Said magnetic-domain control film has lapped with the front face of said central active region partially. The front face of said magnetic-domain control film adhered to said electric conduction film, and it has lapped with the front face of said magnetic-domain control film and said central active region. The lap dimension of said electric conduction film to the front face of said central active region is larger than the lap dimension of said magnetic-domain control film to the front face of said central active region.
[0013] By making the lap dimension to the central active region of the electric conduction film larger than that of the magnetic-domain control film, in the both-sides edge of a central active region, the deadband which originates in the magnetic-domain control film and is produced can be substantially bypassed electrically with the electric conduction film, and increase of the electric resistance value in a magnetic-reluctance sensor circuit can be avoided.
[0014] And according to this invention, the difficulty on manufacture that alignment of the side edge side of the magnetic-domain control film must be correctly carried out so that it may be in agreement with the side edge side of a central active region is avoidable.
[0015] A means to form the magnetic-domain control film and the electric conduction film on mutually different membrane formation conditions in this invention as a means which makes the lap dimension to the central active region of the electric conduction film larger than that of the magnetic-domain control film is adopted. According to this membrane formation approach, the magnetic-domain control film and the electric conduction film can be formed according to an individual so that it may become a suitable lap dimension equally in the both-sides edge of MR film.
[0016] The vacuum membrane formation approaches, such as combination of sputtering, vacuum evaporationo, or both, are included in the membrane formation conditions which should be chosen. Since vacuum evaporationo laps rather than sputtering and a dimension becomes small, the electric conduction film can make the lap dimension between the magnetic-domain control film and the electric conduction film produce a difference by forming membranes by sputtering by the magnetic-domain control film forming membranes by vacuum evaporationo. Moreover, the electric conduction film can be equally formed at the both-sides edge of MR film.

[0017] Even if it is the case where only sputtering is used, various kinds of membrane formation conditions, such as existence of revolution of a substrate, a location of a substrate, sputtering gas **, and distance between spatter ghetto substrates, can be set up, and the magnetic-domain control film and the electric conduction film can be formed according to an individual by optimizing these membrane formation conditions so that it may become a suitable lap dimension equally in the both-sides edge of MR film.
[0018] In manufacturing MR component, the manufacture approach concerning this invention is applied in the manufacture approach of the thin film magnetic head concerning this invention. Therefore, also in the manufacture approach of the thin film magnetic head, the advantage on manufacture of MR component can be acquired as it is.
[0019]
[Embodiment of the Invention] Reference of drawing 1 and 2 supports these for MR component concerning this invention with the substrate 4 including the central active region 1 and the edge passivity fields 2 and 3. The central active region 1 contains the MR film 11, a nonmagnetic membrane 12, and the soft magnetism film 13 (refer to drawing 2). The soft magnetism film 13 impresses horizontal bias to the MR film 11, and constitutes the lowest layer from illustration on a substrate 4. The laminating of the nonmagnetic membrane 12 is carried out on the soft magnetism film 13.
[0020] The laminating of the MR film 11 is carried out on the nonmagnetic membrane 12. The MR film 11 is formed of a permalloy. The presentation, thickness, the manufacture approach, etc. are common knowledge for what has the usual knowledge of the technical field concerned.
[0021] Or there is not nickel-Fe-Rh, nickel-Fe-Cr, or a magneto-resistive effect therefore constituted amorphously, it is a small magnetic film, for example, the soft magnetism film 13 is formed so that it may become 50-300A thickness. A nonmagnetic membrane 12 is constituted by Ta film which has 50-200A thickness. This laminated structure is the structure where it is usually used with this kind of MR component.
[0022] As another example of a configuration in the case of using the magnetic-anisotropy MR film 11, after carrying out the laminating of the soft magnetism film 13, a nonmagnetic membrane 12, and the MR film 11 one by one, the thing of 4 layer structures which carried out the laminating of the Ta film which has about 10-50A thickness on the MR film 11 further is also known.
[0023] As a central active region 1, although the above-mentioned magnetic-anisotropy MR film 11 was used, the thing using the others and spin bulb film, the GMR film using the ferromagnetic tunnel junction effectiveness film, etc. can be used.
[0024] It connects with the both-sides side of the central active region 1, and the edge passivity fields 2 and 3 add a sink or required magnetic bias for a sense current to the central active region 1. The edge passivity fields 2 and 3 contain the magnetic-domain control film 21 and 31. The magnetic-domain control film 21 and 31 adds vertical bias to the MR film 11.
[0025] The hard magnetism film can constitute the magnetic-domain control film 21 and 31. In this case, using the magnetic field produced from the magnetized hard magnetism film 21 and 31, uniform vertical bias is added to the MR film 11, and generating of the Barkhausen noise resulting from a motion of a magnetic domain can be prevented. The example of the hard magnetism film is CoPt, for example, is formed as thickness around 200A.
[0026] The antiferromagnetism film can also constitute the magnetic-domain control film 21 and 31. In this case, using the antiferromagnetism-ferromagnetism switched connection produced between the antiferromagnetism film and the MR film 11, uniform vertical bias is added to the MR film 11, and the Barkhausen noise resulting from a motion of a magnetic domain can be prevented. The example of the antiferromagnetism film is the film of Fe-Mn or nickel-Mn, for example, is formed as thickness around 200A. When the antiferromagnetism film constitutes the magnetic-domain control film 21 and 31, it is necessary to prepare a ferromagnetic in the bottom of it.
[0027] The edge passivity fields 2 and 3 contain the electric conduction film 22 and 32 other than the magnetic-domain control film 21 and 31. Each of the electric conduction film 22 and 32 has the pattern which laps with the magnetic-domain control film 21 and 31 on the field of the central active region 1, and it adheres to it on the magnetic-domain control film 21 and 31. For

this reason, in the both sides of the central active region 1, it can let the electric conduction film 22 and 32 pass, and a sense current can mainly be supplied to the central active region 1. The electric conduction film 22 and 32 consists of a cascade screen of TiW/Ta.

[0028] Near the adhesion field of the magnetic-domain control film 21 and 31 to the MR film 11 Since the vertical bias by the magnetic-domain control film 21 and 31 is strong and horizontal bias does not start, While a limit joins the engine performance as producing the deadband which does not operate as a sensor, and a deadband not functioning as a sensor, but making the electric resistance value of a magnetic-reluctance sensor circuit increase, therefore a magnetic-reluctance sensor circuit It is as having already stated to make the danger of electromigration generating resulting from a high density current amplify.

[0029] As a means to reduce the electric resistance value by the deadband, the lap dimension W2 to the central active region 1 of the electric conduction film 22 and 32 is made larger than the lap dimension W1 of the magnetic-domain control film 21 and 31 in this invention. In this invention, the lap dimension of the magnetic-domain control film 21 and 31 seen on the front face of the central active region 1 or the electric conduction film 22 and 32 is said in the lap dimensions W1 and W2 (refer to drawing 2).

[0030] By making the lap dimension W2 to the central active region 1 of the electric conduction film 22 and 32 larger than the lap dimension W1 of the magnetic-domain control film 21 and 31, in the both-sides edge of the central active region 1, the deadband which originates in the magnetic-domain control film 21 and 31, and is produced can be substantially bypassed electrically with the electric conduction film 22 and 32, and increase of the electric resistance value in a magnetic-reluctance sensor circuit can be avoided.

[0031] The lap dimension w2 of the electric conduction film 22 and 32 to the front face of the central active region 1 is equal in the both-sides edge of the central active region 1.

[0032] The lap field of the electric conduction film 22 and 32 to the front face of the central active region 1 must exceed the deadband produced in the central active region 1. A deadband is usually about 0.15-0.5 micrometers of abbreviation from the side edge side of the central active region 1 depending on the product of the residual magnetic flux density of the magnetic-domain control film 21 and 22, and thickness. Therefore, the lap dimension W2 to the central active region 1 of the electric conduction film 22 and 32 is set as the value exceeding 0.15-0.5 micrometers of abbreviation on condition that usual. If the value of a deadband is changed, of course according to it, the lap dimension W2 is changed.

[0033] It must be determined that spacing between the electric conduction film 22 and the electric conduction film 32 fills the width of recording track demanded in application to the magnetic head. Therefore, the maximum of the lap dimension W2 will receive the limit by the width of recording track in this case.

[0034] This invention permits that the magnetic-domain control film 21 and 31 has the lap dimension W1, and laps with the central active region 1 partially. Therefore, the difficulty on manufacture that alignment of the side edge side of the magnetic-domain control film 21 and 31 must be correctly carried out so that it may be in agreement with the side edge side of the central active region 1 is avoidable.

[0035] In obtaining MR component shown in drawing 1 and drawing 2 , in this invention, the magnetic-domain control film 21 and 31 and the electric conduction film 22 and 32 are formed on mutually different membrane formation conditions. According to this membrane formation approach, the magnetic-domain control film 21 and 31 and the electric conduction film 22 and 32 can be formed according to an individual so that it may become the suitable lap dimensions W1 and W2 equally in the both-sides edge of the MR film 11. Next, with reference to an accompanying drawing, the example of the forming-membranes method concerning this invention is explained.

[0036] Drawing 3 and drawing 4 show first the case where sputtering is adopted as a vacuum forming-membranes method. In drawing 3 , the central active region 1 is already formed on the whole surface of a substrate 4. About the membrane formation approach of the central active region 1, the technique by which have been proposed the technique proposed conventionally or from now on is employable. A substrate 4 is usually a wafer, and on the whole surface, many central active regions 1 were formed and it has aligned. The mask 5 is arranged above the

central active region 1. The illustrated mask 5 is the resist film left behind by the lift-off method used when forming the central active region 1.
[0037] The magnetic-domain control film 21 and 31 carries out spatter membrane formation of the atom which carries out incidence perpendicularly to the whole surface of a substrate 4 on the membrane formation conditions with which it is mainly concerned, as shown in drawing 3 . As shown in drawing 1 and drawing 2 , when the magnetic-domain control film 21 and 31 becomes by CoPt, the atom of Co and Pt which carry out incidence perpendicularly to the whole surface of a substrate 4 is used for membrane formation of the magnetic-domain control film 21 and 31. Since the atom of Co and Pt which carry out incidence perpendicularly to the whole surface of a substrate 4 is mainly used, as shown in drawing 4 , the lap dimension W1 of the magnetic-domain control film 21 and 31 becomes very small.
[0038] As shown in drawing 5 after the membrane formation process of the magnetic-domain control film 21 and 31 shown in drawing 3 and drawing 4 , the electric conduction film 22 and 32 is formed on the membrane formation conditions which are mainly concerned with the atom which carries out incidence in the direction of slant at an include angle theta to the whole surface of a substrate 4. When the electric conduction film 22 and 32 becomes by the cascade screen of TiW/Ta, membrane formation of the TiW film, next spatter membrane formation of Ta film are performed. Since spatter membrane formation of the electric conduction film 22 and 32 is mainly performed in the atom which carries out incidence in the direction of slant to the whole surface of a substrate 4, the lap dimension W2 of the electric conduction film 22 and 32 becomes larger than the lap dimension W1 of the magnetic-domain control film 21 and 31 (refer to drawing 6). According to this structure, in the both-sides edge of the central active region 1, the deadband which originates in the magnetic-domain control film 21 and 31, and is produced can be substantially bypassed electrically with the electric conduction film 22 and 32, and increase of the electric resistance value in a magnetic-reluctance sensor circuit can be avoided.

[0039] And according to the above-mentioned forming-membranes method, the magnetic-domain control film 21 and 31 and the electric conduction film 22 and 32 can be formed according to an individual so that it may become the suitable lap dimensions W1 and W2 equally in the both-sides edge of the MR film 11. For this reason, in the both-sides edge of the MR film 11, the electric conduction film 22 and 32 can be formed equally, and the fall of the magnetic dependability by the MR film 11 in which increase of the electric resistance value depended unequally or lower layer actuation of the electric conduction film 22 and 32 is possible can be avoided certainly. A mask 5 is removed after the electric conduction film membrane formation process shown in drawing 5 and drawing 6 is completed (refer to drawing 7).
[0040] Drawing 8 and drawing 9 show another example. Also in this example, sputtering is adopted as a vacuum forming-membranes method. The substrate 4 in which the central active region was formed on the whole surface is carried on the rotor plate 60. The rotation drive of the rotor plate 60 is carried out in the direction of an arrow head a1 by the driving gear which is not illustrated (refer to drawing 9). Suppose that rotation of the rotor plate 60 in this case is called revolution. Above the rotor plate 60, the target 61 of Co and Pt and the target 62 of Ta are arranged. A rotor plate 60 and targets 61 and 62 are arranged inside the vacuum membrane formation room 6.
[0041] first, the magnetic-domain control film makes a rotor plate 60 stand it still, as shown in drawing 8 -- it quiescence-forming [membranes]-method-******. Spatter membrane formation of the magnetic-domain control film is carried out on the membrane formation conditions which are mainly concerned with the atom which carries out incidence perpendicularly to the whole surface of a substrate 4 by this.
[0042] Next, as shown in drawing 9 , spatter membrane formation of the electric conduction film is carried out by the rotation forming-membranes method make a rotor plate 60 revolve around the sun in the direction of an arrow head a1. Thereby, about the atom in which spatter membrane formation of the electric conduction film carries out incidence in the direction of slant to the whole surface of a substrate 4, it is mainly carried out and the lap dimension of the electric conduction film becomes larger than the lap dimension of the magnetic-domain control film.

[0043] Moreover, the lap dimension of the magnetic-domain control film and the electric conduction film can be adjusted by changing the distance of the target 61 to a substrate 4, and the distance of a target 62. In order to make it the lap dimension of the electric conduction film become larger than the lap dimension of the magnetic-domain control film, distance of the target 61 to a substrate 4 is usually made larger than the distance of the target 62 to a substrate 4.
[0044] Drawing 10 and drawing 11 show another example of the manufacture approach concerning this invention. Also in this example, sputtering is adopted as a vacuum forming-membranes method. The substrate 4 in which the central active region was formed on the whole surface is carried on the rotor plate 60. The magnetic-domain control film forms membranes with the combination of the diaphragm with a mask 63, and the rotation forming-membranes method make a rotor plate 60 revolve around the sun, as shown in drawing 10 . Even if it makes a rotor plate 60 revolve around the sun, in order that the diaphragm with a mask 63 may work, spatter membrane formation of the magnetic-domain control film is carried out on the membrane formation conditions which are mainly concerned with the atom which carries out incidence perpendicularly to the whole surface of a substrate 4.
[0045] Next, the electric conduction film forms membranes by the rotation forming-membranes method make a rotor plate 60 revolve around the sun, as shown in drawing 11 .
[0046] Drawing 12 and drawing 13 are drawings showing still more nearly another example of the manufacture approach concerning this invention. Sputtering is adopted as a vacuum forming-membranes method. In this example, the 1st rotor plate 60 and 2nd rotor plate 65 are included. The 2nd rotor plate 65 is formed on the 1st rotor plate 60 in the location separated from the center of rotation. The 1st rotor plate 60 revolves around the sun in the direction of an arrow head a1, and the 2nd rotor plate 65 rotates in the direction shown by the arrow head b1 (refer to drawing 13). The substrate 4 which has already formed the central active region attaches offset **d from the rotation core of the 2nd rotor plate 65, and is formed on the whole surface of the 2nd rotor plate 65.
[0047] First, the magnetic-domain control film forms membranes with the combination of the diaphragm with a mask 63, and the rotation forming-membranes method make the 1st rotor plate 60 revolve around the sun, as shown in drawing 12 . Even if it makes the 1st rotor plate 60 revolve around the sun, in order that the diaphragm with a mask 63 may work, spatter membrane formation of the magnetic-domain control film is carried out on the membrane formation conditions which are mainly concerned with the atom which carries out incidence perpendicularly to the whole surface of a substrate 4.
[0048] Next, as shown in drawing 13 , the electric conduction film stops revolution of the 1st rotor plate 60, and forms membranes by the rotation forming-membranes method make the 2nd rotor plate 65 rotate like an arrow head b1. Since a substrate 4 attaches offset **d from the rotation core of the 2nd rotor plate 65 and it is prepared on the whole surface of the 2nd rotor plate 65, about the atom in which spatter membrane formation of the electric conduction film carries out incidence in the direction of slant to the whole surface of a substrate 4, it is mainly carried out and the lap dimension of the electric conduction film becomes larger than the lap dimension of the magnetic-domain control film.
[0049] Drawing 14 shows still more nearly another example of the manufacture approach concerning this invention. The description of this example is having formed the magnetic-domain control film and the electric conduction film in a different vacuum membrane formation room 71-73. The substrate 4 in which the central active region was formed is taken by for example, robot 8 grade in and out in each vacuum membrane formation room 71-73. The case where an example constitutes the magnetic-domain control film by CoPt, and TiW/Ta constitutes the electric conduction film is shown, and it has the vacuum membrane formation room 71 for CoPt membrane formation, the vacuum membrane formation room 72 for Ta membrane formation, and the vacuum membrane formation room 73 for TiW membrane formation, and a robot 8 drives so that it may display by the arrow head c1, and he takes a substrate 4 in and out among the vacuum membrane formation rooms 71-73 according to membrane formation sequence. The number of vacuum membrane formation rooms prepares only the number according to the number of film which should be formed. As membrane formation conditions which should be chosen at the vacuum membrane formation rooms 71-73, the vacuum membrane formation

approaches, such as combination of sputtering, vacuum evaporationo, or both, are included. Since vacuum evaporationo laps rather than sputtering and a dimension becomes small, vacuum evaporationo can perform membrane formation of the magnetic-domain control film in the vacuum membrane formation room 71, and sputtering can perform membrane formation of the electric conduction film in the vacuum membrane formation rooms 72 and 73. Thereby, the lap dimension between the magnetic-domain control film and the electric conduction film can be made to produce a difference. Moreover, the electric conduction film can be equally formed at the both-sides edge of MR film.

[0050] Next, a concrete example is explained. Table 1 shows the data at the time of forming membranes by the membrane formation approach as shown in drawing 8 and drawing 9 .

表 1

条件 ＼ 膜	CoPt	Ta
成膜法	スパッタリング	スパッタリング
基板静止／回転	静止	回転
基板オフセット	なし	なし
スパッタガス (Pa)	0.1	0.5
基板ーターゲット間距離	150	70
重なり寸法 (W1, W2)	0.1	0.3

[0051] As shown in Table 1, the lap dimension W2 of the electric conduction film constituted by Ta was set to 0.3 micrometers to the lap dimension W1 of the magnetic-domain control film constituted by CoPt being 0.1 micrometers. Table 1 has given the optimal lap dimension in case the deadband seen at one side is 0.2 micrometers. To the dimension of a different deadband, membrane formation conditions can be changed and the optimal lap dimensions W1 and W2 for the dimension of the deadband can be obtained.

[0052] The sectional view of the thin film magnetic head which drawing 15 read MR component mentioned above, and used it as a component, wrote in the induction type MR component and was used as a component is shown. Drawing 16 is the expanded sectional view of the magnetic sensing-element part of the thin film magnetic head shown in drawing 15 .

[0053] The thin film magnetic head of illustration has the write-in component 9 which consisted of MR components on the slider 100 and which reads and becomes with a component 8 and an induction type MR component.

[0054] The insulator layer which becomes in aluminum 2O3 or SiO2 grade is prepared on the base which a slider 100 consists of the ceramic structures and becomes by aluminum2O3-TiC etc. A slider 100 has the air bearing side (an ABS side is called below) 101 in the magnetic-disk and whole surface side which counters. As a slider 100, the rail section is prepared in the magnetic-disk and field side which counters, it is the plane to which the magnetic-disk and field side which counters does not have the rail section out of the type which uses the front face of the rail section as an ABS side, and the plane type which uses the whole surface as an ABS side mostly is known.

[0055] The reading component 8 is laid under the interior of an insulator layer 4 in the shape of film. A reference mark 81 is the lower shielding film, and is constituted by magnetic films, such as Sendust, a permalloy, or nitriding iron. The reading component 8 contains the up shielding film 91. The up shielding film 91 is constituted by magnetic films, such as a permalloy or nitriding iron.

[0056] The reading component 8 consists of MR components obtained by the manufacture approach concerning this invention mentioned above. Therefore, the thin film magnetic head which has MR component which does not cause the electric resistance value increase by the deadband can be obtained.

[0057] The write-in component 9 has the gap film 94 which becomes with the lower magnetic film 91 which serves as the up shielding film, the up magnetic film 92, the coil film 93, an alumina, etc., the insulator layer 95 which consisted of organic resin, a protective coat 96, etc., and the laminating is carried out on the insulator layer 4. The points of the lower magnetic film 91 and the up magnetic film 92 are the pole sections P1 and P2 which separate the gap film 94 of minute thickness and counter, and write in in the direction of an arrow head X in the pole sections P1 and P2 to the magnetic disk (not shown) which carries out high-speed migration.

The lower magnetic film 91 and the up magnetic film 92 of each other are combined so that a magnetic circuit may be completed in the back gap section which has the York section in the opposite side in the pole sections P1 and P2. The coil film 93 is formed so that it may turn around the bond part of the York section spirally on an insulator layer 95. It writes in, and it is a mere example and a component 9 is not the illustrated thing which is limited to such structure.
[0058]
[Effect of the Invention] As stated above, according to this invention, MR component which does not cause the electric resistance value increase by the deadband, the thin film magnetic heads, and those manufacture approaches can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of MR component obtained by the manufacture approach concerning this invention.
[Drawing 2] It is a sectional view on the 2-2 line of drawing 1 .
[Drawing 3] It is drawing showing the production process for obtaining MR component shown in drawing 1 and drawing 2 .
[Drawing 4] It is drawing showing the condition after passing through the process shown in drawing 3 .
[Drawing 5] It is drawing showing the process after the process shown in drawing 3 and drawing 4 .
[Drawing 6] It is drawing showing the condition after passing through the process shown in drawing 5 .
[Drawing 7] It is drawing showing the process after passing through the process of drawing 5 and drawing 6 .
[Drawing 8] It is drawing showing the example of the manufacture approach concerning this invention roughly.
[Drawing 9] It is drawing showing roughly the process after the process shown in drawing 8 .
[Drawing 10] It is drawing showing roughly another example of the manufacture approach concerning this invention.
[Drawing 11] It is drawing showing roughly the process after the process shown in drawing 10 .
[Drawing 12] It is drawing showing roughly another example of the manufacture approach concerning this invention.
[Drawing 13] It is drawing showing roughly the process after the process shown in drawing 12 .
[Drawing 14] It is drawing showing roughly another example of the manufacture approach concerning this invention.
[Drawing 15] It is the expanded sectional view of the thin film magnetic head obtained by the manufacture approach concerning this invention.
[Drawing 16] It is the expanded sectional view of the magnetic sensing-element part of the thin film magnetic head shown in drawing 15 .
[Description of Notations]
1 Central Active Region
2 Three Edge passivity field
21 31 Magnetic-domain control film
22 32 Electric conduction film
W1 Lap dimension of the magnetic-domain control film
W2 Lap dimension of the electric conduction film

[Translation done.]

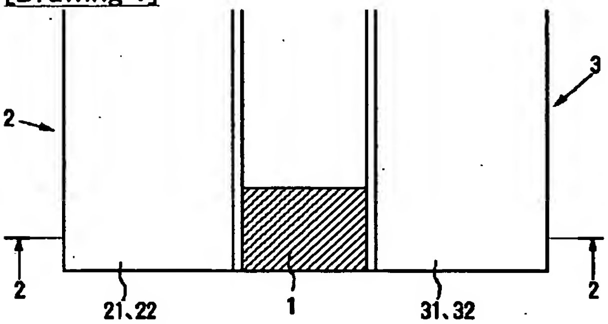
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

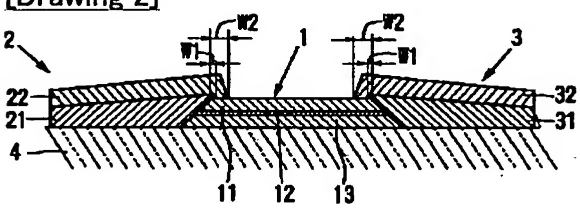
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

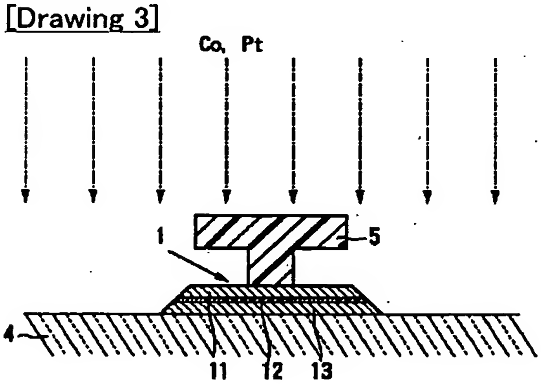
[Drawing 1]



[Drawing 2]



[Drawing 3]



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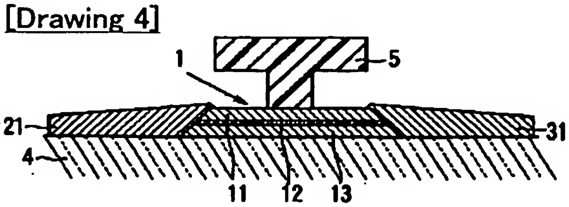

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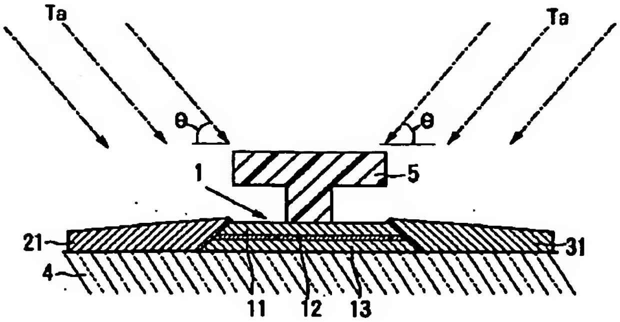

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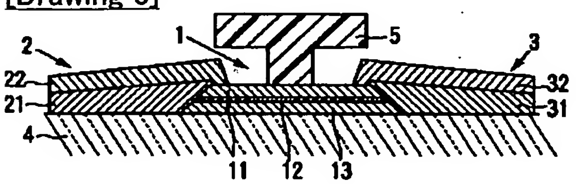

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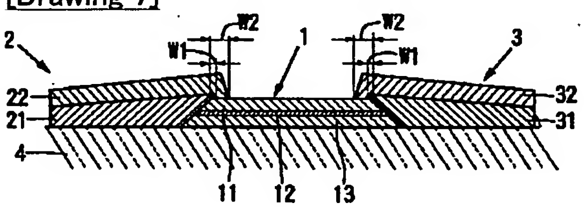
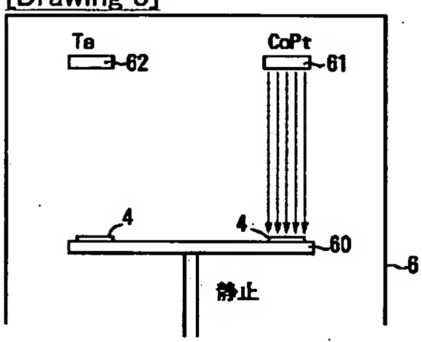
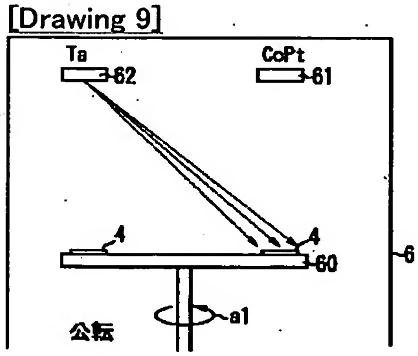


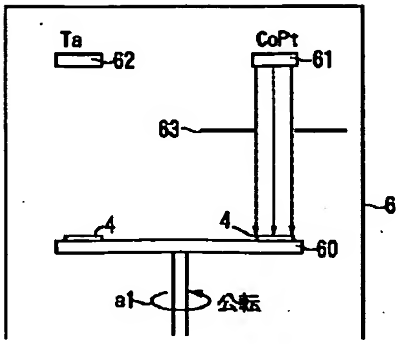
[Drawing 8]



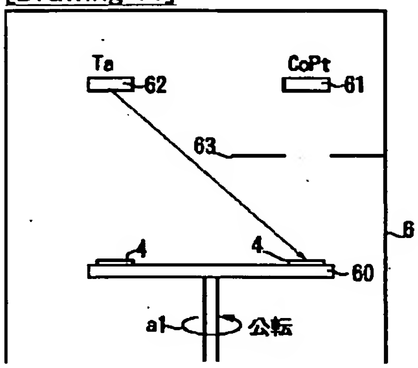
[Drawing 9]



[Drawing 10]



[Drawing 11]



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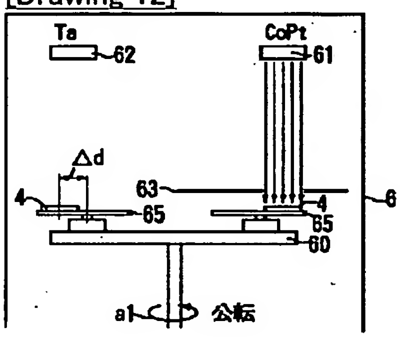
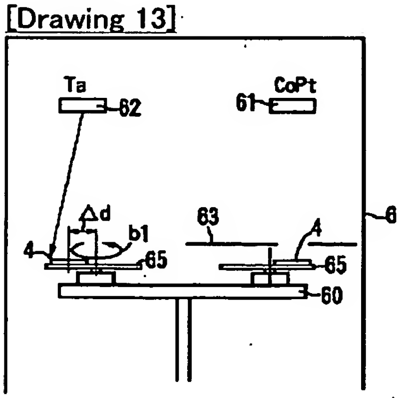


[Drawing 13]



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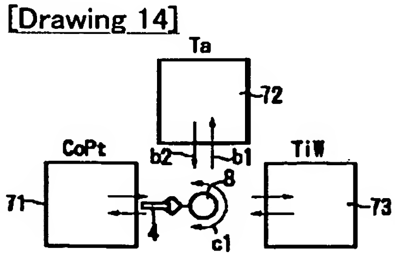
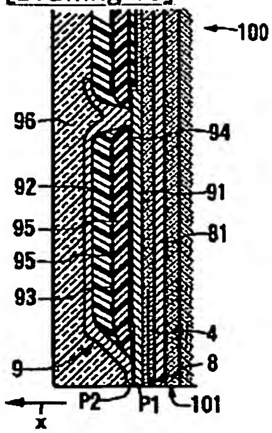
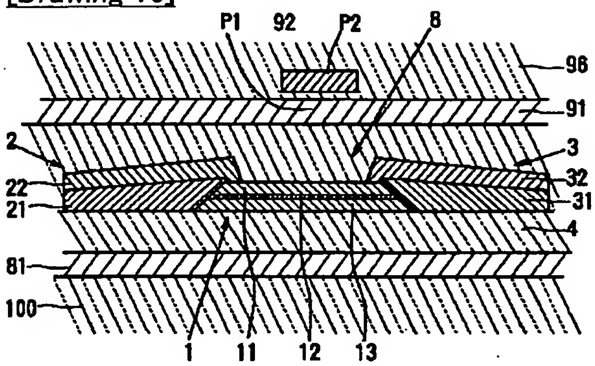


[Drawing 15]



[Drawing 16]



[Translation done.]